Saskatchewan Research Council

Agriculture, Biotechnology and Food

January 2008

New vaccine with help secure food chain 1

Biomass to ethanol: the road to production 2

New DNA technology helps ensure food quality 3

www.src.sk.ca

SRC™
smart science solutions

New vaccine will help secure food chain

SRC's facilities and expertise mean a new swine vaccine is now being manufactured in Saskatchewan.

Bacterial infections in livestock have long been a concern for the animal health and agri-food sectors in Canada. Research and development of animal vaccines is ongoing, as new and more effective products are needed. While Canada has been a leader in vaccine development, there is still a lack of manufacturing infrastructure for new vaccines here, particularly to meet stringent domestic regulations.

The Canadian Food Inspection Agency (CFIA) works to safeguard the health of animals and plants. It plays an important role in the animal vaccine industry by enforcing strict safety regulations designed to protect animals, the environment, and the food supply. Canada has built an international reputation for having a safe and secure food supply.

When developing and manufacturing vaccines, researchers and companies work with CFIA to ensure they meet guidelines and the vaccine quality meets international standards.

Prevtec Microbia Inc., an animal health company based in Quebec, has developed a new, highly effective vaccine, known as Coliprotec. However, its challenge was not having facilities to produce it in the quantities needed for commercialization. Coliprotec controls post-weaning diarrhea in pigs, a disorder that can spread and ultimately destroy an entire population.

continued on page 2

Saskatchewan Research Council

New Vaccine

continued from page 1

SRC's biosafety level 2 Fermentation Pilot Plant is able to produce the required amount of the vaccine and has the quality control systems in place to meet the stringent regulations. In 2006, Prevtec partnered with SRC to carry out the testing required to secure regulatory approval to produce the vaccine commercially.

To obtain licensing, SRC's laboratories demonstrated they could produce a consistent product. This involved testing for purity, potency, and identity on three different batches of vaccine by SRC and CFIA's Biologics Evaluation Laboratory. The product was also safety tested in animals and CFIA inspected SRC's labs for quality control, work safety, and production to ensure all necessary requirements were in place.

On November 2, 2007, SRC and Prevtec successfully completed pre-licensing work and received a Veterinary Biologics Establishment License. This gives SRC's Fermentation Pilot Plant a unique status as the only contract research organization in Canada with this type of license. It represents a significant accomplishment for the entire Canadian industry, as Coliprotec is one of the few licensed animal vaccines developed and manufactured in Canada.

The collaborative work of Prevtec and SRC is a great example of overcoming industry challenges as the partners created a manufacturing infrastructure where there previously had been none. The advanced capabilities of SRC's Fermentation Pilot Plant will provide significant benefits for Canada's animal health and agri-food sectors as researchers are able to produce safe, reliable vaccines domestically, while ensuring the safety and health of animals. ■

Biomass to ethanol: *the road to production*

Biotechnology and bio-based industries are growing rapidly around the world. In North America, environmental concerns such as climate changing emissions, global warming, and the need for alternative energies for greater energy security have driven growth. Currently, the liquid fuel leading that growth trend in the transportation industry is ethanol.

In North America, ethanol production usually employs a corn or wheat fermentation process, as it is reliable and economical. However, this technology may not meet the future demand for ethanol as the amount of wheat and corn required is extremely high. In the future, agriculture and forestry waste such as branches leftover from forestry operations, saw mill waste, or straw, will likely be the main feedstock for production using this new technology.

Researchers are looking at two potential solutions to meet increasing demand for ethanol produced from waste. The first, called the sugar platform, uses new processes to produce sugar, which is then fermented using existing grain-based technologies, with minor modifications, to produce ethanol. With the second option, called the thermal platform, biomass decomposition leads to intermediate products that are then transformed using a catalytic process to produce ethanol.

The major advantages of the thermal platform are that a wide range of feedstocks, such as forestry and agricultural waste, can be used and 100% of the feedstock is utilized to produce ethanol. The current sugar platform only uses about 50% of the feedstock biomass.

A location along the Saskatchewan forest/grassland transition zone, which connects the northern forestry and southern agricultural areas, is ideal for building a commercial ethanol facility due to its close proximity to both forestry and agricultural waste.

The community of Nipawin, which is located in this transition zone, brought together a strong and diverse group of investors to form the Nipawin Biomass Ethanol New Generation Co-operative Ltd. to drive this development.

Preliminary work by SRC and other organizations led to the recommendation to develop a suitable technology to produce ethanol. With the support of the Nipawin Co-operative, and research funding from the federal and provincial governments, SRC took on this multi-year project.

SRC developed technology based on gasification of biomass waste. The process thermally breaks down the biomass into a synthesis gas primarily made up of hydrogen and carbon monoxide. This gas passes through a chamber containing a proprietary material, known as a catalyst, which enable chemical reactions to produce ethanol.

The commercial application of thermal technology will meet the Nipawin New Generation Co-operatives objectives as well as open up new opportunities for the existing grain-based ethanol industry to improve energy efficiency. ■

Forestry residue from trees and branches are fuelling new technology to produce ethanol.

New DNA technology helps ensure food quality

With increasing global concern about food safety and quality, consumers are placing considerable pressure on the food industry to establish traceability of animal products and production. Consumers want assurances that the premium meat they buy is in fact, premium, and that the meat in the supermarket is from a healthy animal.

DNA detection technology is a very powerful tool for parentage verification, meat traceability, and tracking meat back to its original source. A new technology called Single Nucleotide Polymorphism or SNP is replacing the current, conventional technology used in DNA detection.

Linking the parentage of cattle means meat can be traced to its producer of origin, which helps predict diseases affecting the cattle industry.

DNA code is made up of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). The combination of these creates units within a DNA sequence. A SNP is a single change in DNA at a specific location. For example, at a specific point in the DNA sequence an A may be replaced with a C when comparing sequences from different individuals. That change in the SNP results in trait differences such as those between hair colours.

Current DNA detection and parentage verification is based on microsatellite DNA technology. In this process, parentage is verified by measuring the number and length of repeated units in multiple DNA sequences, such as the number of times the chemical bases AT are repeated in a sequence. This technology is very time consuming, labour-intensive, expensive and limited by availability of desired markers. With an extraordinary capacity, SNP technology allows researchers to analyze more samples in a shorter period of time with a larger span

continued on page 4

DNA *(continued from page 3)*

of detection capabilities.

Application of DNA technology, particularly chip-based detection, is a very important tool. A genetic profile of an individual can fit on a tiny SNP chip, a tool used to store SNP data, like a computer chip. With the SNP chip, several traits can be analyzed simultaneously. For example, a parentage SNP chip can contain SNP for parentage verification and additional SNPs for important traits such as coat colour.

With new SNP technology, researchers can analyze DNA samples more quickly.

Due to high costs, development and application of these types of DNA chips is currently limited to the pharmaceutical industry. However, recently, researchers in the plant and animal industries are beginning to develop and utilize DNA detection technologies, such as SNP technology, because of its broad capabilities.

The big push to use SNP technology is driven by food quality and safety concerns. Meat traceability is being advocated to strengthen consumer confidence in the food industry. Rapid DNA detection is using parentage SNPs to trace meat samples back to original parentage providing consumer assurance by knowing what quality their meat is or what animal it came from.

The capability of SNP technology far surpasses more traditional methods as it allows for faster DNA detection in a larger quantity of samples while delivering thorough results. By ensuring reliable traceability of meat and parentage, the food industry can better address consumer concerns. ■

PUBLICATIONS MAIL AGREEMENT NO 40064877
RETURN UNDELIVERABLE CANADIAN ADDRESSES TO
SASKATCHEWAN RESEARCH COUNCIL
125 15 INNOVATION BOULEVARD
SASKATOON SK S7N 2X8

SRC™
smart science solutions